iMPACT4: A Framework for Rapid, Modular Construction of Web-based Patient Decision Support Systems and Preference Measurement Tools

Aditya Bansod, Steven Skoczen, and Leslie A. Lenert, M.D.
Veterans Medical Research Foundation and the University of California, San Diego

Abstract:

In order to rapidly develop reusable software we created a framework named iMPACT4 in Macromedia Flash and XML. The functional requirements were for the ability to measure quality of life and provide decision support thus rendering four design goals: rich client-side state navigation control, reusable components, compatibility, rich navigation, and increased usability. Results suggest that the revised system provides many of the advanced navigation capabilities of server side control of software while continuing to offer the web-based design and automated website generation capabilities of our previous software.

The web is increasingly used by patients to help inform medical decision-making. Creating web sites for patients is complex and expensive. In the past few years, computer tools to facilitate construction of web sites for decision making and the study of patient preferences have progressed greatly. Most software, however, is custom-made one-of-a-kind work and hence is expensive. There have been several different strategies developing patient oriented systems, including paper, videodiscs, Hypercard-like programs, Director, HTML/JavaScript, and server side scripting of web sites. Each of these approaches brings a different strength, but in each are fundamental weaknesses. In looking towards an improved framework, the main weaknesses across and within these systems are: linear navigation, one-way data communication, unintuitive design or lack of interactive media, and a high cost to modify the survey or intervention. On computer-only frameworks, concerns also arise regarding cross-platform and cross-browser compatibility, and performance across slower Internet connections.

In work to address these issues, we developed iMPACT3 (1). Its design was based on the theory that use of client side software to control state and navigation would allow automated construction of web sites using web based tools. In practice, this approach has been highly successful with hundreds of users designing and building web sites. However, the current technology, based on JavaScript and cookie technology has limitations. The most significant limitation was the restriction to mostly linear navigation.

An ideal computer-based framework would build upon client side strategies for maintain state, but would include nonlinear, rich navigation and modular, reusable components. To achieve these goals, iMPACT4 was created to utilize reusable Flash components ("modules") directed by a XML specification. The modules are standard Macromedia Flash movies that implement the iMPACT4 API and are executed according to the XML specification. Since researchers can use existing modules (such as generic number pickers) instead of re-developing from basic tools scratch, development costs are reduced.

Flash modules offer significant improvements over an HTML or Java-based frameworks that typically require versions for each browser and operating system. Flash also provides scaling, which ensures that the visual look of the survey remains consistent regardless of the system screen size. Flash also supports scalability across media, and access to Macromedia's accessibility frameworks for disabled users, including a screen reader, visual magnifiers and other assistive software systems. Designers can leverage vector graphics and rich multimedia feedback to design better interfaces and controls for patient systems. Since Flash's user-interface is time-based, researchers are able to bypass the server-browser paradigm for control of the sequence of display of images and text to create more interactive designs.

iMPACT4 supports nonlinear and conditional navigation of the web site, on the client side, via the XML that links Flash modules. Survey flow can be affected by conditions, directed to a random choice of several options or looped through a specified set of modules. Examples of conditional navigation include decisions based on user responses, database queries, or logic checks. Rich navigation allows researchers to tailor and more accurately explore a subject's views. The entire specification for navigation of a survey is laid out in XML, thus allowing it to be readable and easily maintainable. An investigator can extend the survey by writing additional lines into the XML document, thus extending it without any programming. It should also be feasible to automate production of web sites similar to iMPACT3.

References:

(1) Lenert L. Sturley A, Watson, M. iMPACT3: Internet-based development and administration of utility elicitation protocols. *Med Decis Making.* 2002 Nov-Dec;22(6):464-74.